Miniaturized, High-Reliability CubeSat Release Mechanism

Completed Technology Project (2015 - 2016)

Project Introduction

This proposal describes a Phase I effort aimed at using additive manufacturing (AM) and a commercial partnership to build a miniaturized, general purpose CubeSat release mechanism. The objective of Phase I is to demonstrate the feasibility of combining an "off the shelf", high-reliability actuator with a GSFC designed mechanism and CubeSat power and volume constraints to achieve a multi-purpose CubeSat release mechanism.

The intention of this Phase I effort is to demonstrate the design and proof of concept of a miniaturized release mechanism. As part of that effort, it is our intention to demonstrate the value of using both additive manufacturing (AM) techniques and a commercial partnership to build a miniaturized, general purpose CubeSat release mechanism. The objective of Phase I is to demonstrate the feasibility of combining an "off the shelf", high-reliability actuator with a GSFC designed mechanism and CubeSat power and volume constraints to achieve a multi-purpose CubeSat release mechanism.

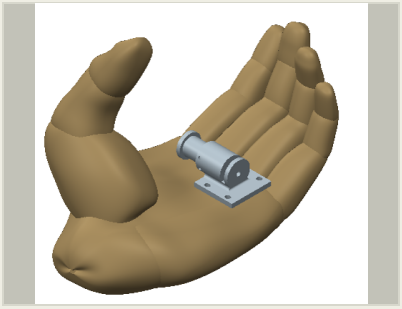
Traditional CubeSat release systems have utilized a burn wire approach for releasing spacecraft systems. There is mounting evidence that these burn wire systems have high failure rates. Additionally, these burn wire systems require refurbishment after every test. This Early-Stage Innovation will demonstrate a high-reliability system that maintains compatibility with CubeSat power and electrical systems. In addition, it is envisioned that a re-settable CoTS actuator can be used that will allow the release mechanism to be reset after every use rather than being replaced.

This effort will be broken into 2 phases. The first phase will be the design or a release mechanism that can meet the needs of multiple deployable spacecraft systems. The design will be accomplished using GSFC Computer Aided Design tools. The second phase will then produce a physical, functional model of the proposed design. It is anticipated that the second phase may uncover issues with the design which will then be corrected. The appeal of printing the prototype model is that there can be a quick turn-around between design iterations.

Anticipated Benefits

A small, highly reliable release mechanism will benefit many of the small satellites known as CubeSats that are being proposed by NASA & Goddard Space Flight Center. Many of these small satellites have key deployable systems - like solar arrays, antennas and scientific instruments - that are critical to mission success. Ensuring that all of these systems sucessfully deploy creates opportunities for new scientific discoveries.

There are several federal agencies that are evaluating the applicability of CubeSats to what they do. The Department of Defense and the National Oceanic & Atmospheric Administration either have projects in work or are



One Potential Actuator Concept for a Minaturized Release Mechanism

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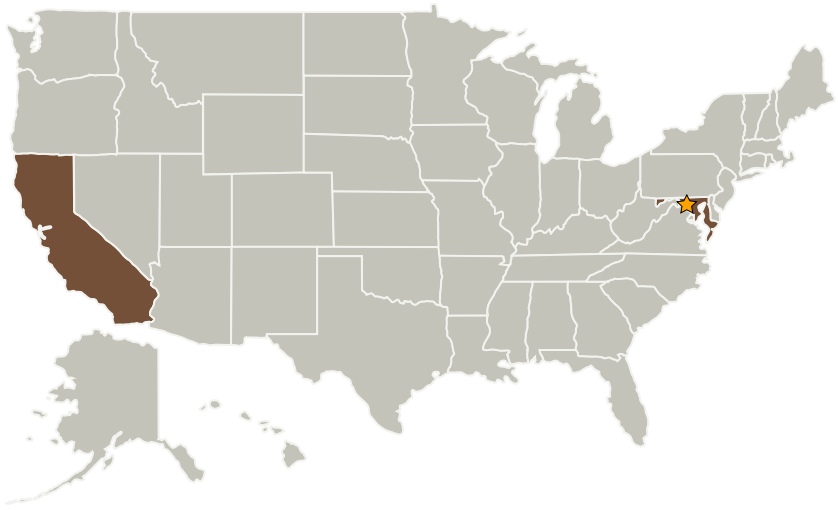
considering missions that could be better accomplished through the use of CubeSats. Having a reliable means to deploy components on those missions would enhance their value to their respective agencies.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Co-Funding Partners	Type	Location
TiNi Aerospace, Inc.	Industry	San Rafael, California

Primary U.S. Work Locations	
California	Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Manager:

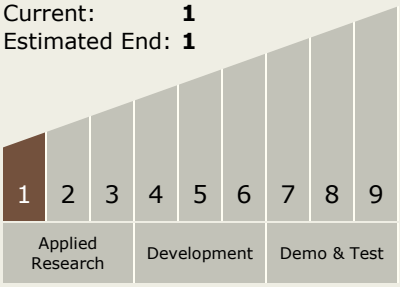
Michael J Viens

Principal Investigator:

James A Sturm

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **1**



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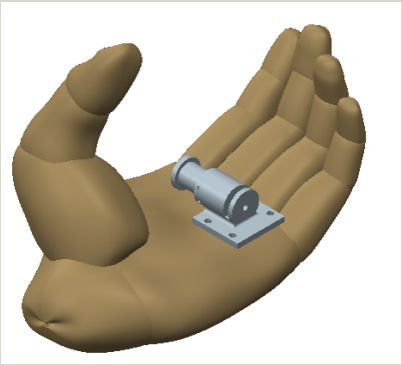
Images



Actuator Concept
One Potential Actuator Concept for a Minaturized Release Mechanism *(https://techport.nasa.gov/image/19089)*

Project Website:

http://aetd.gsfc.nasa.gov/

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.3 Mechanical Systems
    - TX12.3.2 Electro-Mechanical, Mechanical, and Micromechanisms